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Abstract

Loan repayment performance is critical for the sustainability of Women's Savings and Credit Cooperatives (WSCCs). This study identifies factors affecting loan repayment among WSCC members in East Hararghe, Ethiopia, focusing on training, education, loan characteristics, and economic shocks. A mixed-methods approach was employed with

102 borrowers across 67 WSCCs (59.3% sampling fraction). A Two-limit Tobit model with cluster-robust standard errors and instrumental variable estimation (distance to training center) was employed. Average repayment was 85.6% (SD=12.3), ranging from 48% to 100%. Interest rates significantly reduced repayment ($\beta = -1.109$, $p < 0.01$). Education increased repayment by 1.22 percentage points per year ($p < 0.01$). Training increased repayment by 8.07 percentage points ($p < 0.01$)—large enough to offset the negative impact of an economic shock (7.17 percentage points). Business loans outperformed other loans by 7.07 percentage points ($p < 0.01$). Previous repayment history had the largest effect ($\beta = 11.168$, $p < 0.01$). IV estimates confirmed the training effect (first-stage $F = 18.34$). Qualitative findings revealed mechanisms: training improved business performance and financial literacy; educated borrowers managed cash flows better; business loans generated steady income; and shocks disrupted repayment. Training can fully offset the negative impact of economic shocks. WSCCs should mandate business training, maintain affordable interest rates, prioritize business loans, and develop shock-responsive lending mechanisms

Keywords: Loan repayment; women's cooperatives; microfinance; training; credit-plus model; economic shocks; Ethiopia; Two-limit Tobit; instrumental variables

1. Introduction

Loan repayment performance is a critical indicator of financial discipline among borrowers and reflects the overall health and sustainability of lending institutions [1, 2]. For Women's Savings and Credit Cooperatives (WSCCs), high repayment rates are essential for financial sustainability, enabling the recycling of funds to serve more members and maintain institutional viability [3, 4]. When repayment rates are high, WSCCs can continue

to provide credit to members, expand their outreach, and build the trust and confidence necessary for member engagement. Conversely, when repayment rates decline, WSCCs face liquidity constraints, reduced capacity to serve members, and potential institutional collapse. The sustainability of WSCCs thus depends critically on understanding and managing the factors that influence borrower repayment behavior.

In Ethiopia, WSCCs have been promoted as vehicles for financial inclusion and women's economic empowerment [5, 6]. These cooperatives provide women with access to savings mechanisms and credit at interest rates lower than informal moneylenders, who often charge exorbitant rates [7]. By enabling women to access formal financial services, WSCCs aim to help women invest in income-generating activities, build assets, and manage risk [8]. According to the East Hararghe Zone Cooperative Promotion Office, there were 113 WSCCs operating in the zone at the time of the study, from which 67 WSCCs (59.3% sampling fraction) were selected for this research.

However, preliminary evidence suggests inconsistent repayment performance, with some cooperatives reporting repayment rates as low as 65% [5]. This variation threatens institutional sustainability and limits the ability of WSCCs to serve their members effectively. Understanding the factors that drive loan repayment is crucial for designing effective lending programs, managing risk, and ensuring the long-term viability of WSCCs [9, 10].

Despite the importance of loan repayment for WSCC sustainability, empirical evidence on repayment determinants in the Ethiopian context remains limited. Previous studies have examined repayment behavior in microfinance institutions more broadly [11, 12], but

few have focused specifically on women's cooperatives in rural Ethiopia. Moreover, the role of training as a determinant of repayment—and its potential to offset the negative effects of economic shocks—has received limited attention. This is a significant gap, as training is a potentially powerful intervention that can build the skills and capabilities needed for successful loan utilization and repayment.

Three critical gaps persist in the literature. First, the relative importance of borrower characteristics versus loan characteristics in determining repayment is unclear. Is education more important than loan size? Do interest rates matter more than loan purpose? Without understanding relative importance, WSCCs cannot prioritize interventions effectively. Second, the extent to which training can mitigate the negative effects of economic shocks on repayment has not been adequately quantified. This is particularly important in rural Ethiopia, where households face frequent shocks—drought, illness, price collapses—that can disrupt repayment. Third, the differential repayment performance of loans for different purposes has not been systematically examined. Should WSCCs encourage business loans over agricultural loans? This question has important implications for loan product design.

This study addresses these gaps with five objectives: (1) to describe loan repayment patterns among WSCC members in East Hararghe Zone, Ethiopia, including variation by loan purpose and borrower characteristics; (2) to identify borrower characteristics that affect loan repayment performance, including education, income, family size, and previous repayment history; (3) to identify loan characteristics that affect loan repayment performance, including loan amount, interest rate, and loan purpose; (4) to examine the role of training and economic shocks in shaping repayment outcomes, including

quantifying the potential for training to offset shock effects; and (5) to address endogeneity of training using instrumental variables to obtain causal estimates of training effects.

The study makes several contributions. Theoretically, it tests predictions from utility theory [13], human capital theory [14], vulnerability theory [15], and the credit-plus model [16]. Methodologically, it demonstrates the application of advanced econometric methods including Two-limit Tobit, cluster-robust standard errors, and instrumental variable estimation. Empirically, it provides rigorous estimates of loan repayment determinants in Ethiopian WSCCs, including the novel finding that training can fully offset the negative impact of economic shocks. Practically, it offers evidence-based recommendations for WSCC management, policymakers, and development practitioners.

2. Literature Review

2.1 Theoretical Framework

This study draws on three complementary theoretical perspectives to explain loan repayment behavior: utility theory, human capital theory, and vulnerability theory. These theories provide a comprehensive framework for understanding how borrowers make repayment decisions and how external factors influence their capacity to repay.

2.1.1 Utility Theory

Utility theory, as developed by Von Neumann and Morgenstern [13] and extended by subsequent economists, provides a foundation for understanding borrower decision-making. According to utility theory, individuals make choices to maximize their expected utility, weighing the benefits and costs of different actions. In the context of loan

repayment, borrowers compare the utility of repaying against the utility of defaulting [2, 11].

The benefits of repayment include: maintaining access to future credit; preserving reputation and social standing; avoiding social sanctions from the group or community; and maintaining membership in the cooperative. The costs of repayment include: forgoing consumption or investment; liquidating assets; and diverting resources from other uses. The benefits of default include: retaining funds for other uses and avoiding immediate financial strain. The costs of default include: loss of future credit access; social sanctions and reputational damage; and potential legal consequences.

Utility theory predicts that borrowers are more likely to repay when the benefits of repayment outweigh the costs. Factors that increase the benefits of repayment (e.g., future credit access, social capital) or decrease the costs of repayment (e.g., higher income, training that improves business performance) should increase repayment rates. Conversely, factors that increase the costs of repayment (e.g., high interest rates, economic shocks) should decrease repayment rates.

H1: Higher interest rates have a negative effect on loan repayment performance.

2.1.2 Human Capital Theory

Human capital theory, developed by Becker [14] and extended by Schultz [17], emphasizes that education and training enhance individuals' cognitive skills, decision-making abilities, and productivity. Human capital investments increase individuals' capacity to process information, evaluate options, and make effective decisions.

In the context of loan repayment, human capital theory suggests that more educated borrowers are better able to: evaluate investment opportunities and choose profitable

activities; manage cash flows and plan for repayment; understand loan terms and conditions; navigate challenges and adapt to changing circumstances; and keep accurate records and monitor business performance.

Training programs that build financial literacy and business management skills can similarly enhance repayment capacity. These programs may improve borrowers' ability to allocate loan funds productively, manage business operations, and navigate financial challenges [18]. The "credit-plus" model—integrating credit with training—is based on the premise that credit alone is insufficient; borrowers need skills to use credit productively [16].

H2: Education has a positive effect on loan repayment performance.

H3: Training participation has a positive effect on loan repayment performance.

2.1.3 Vulnerability Theory

Vulnerability theory, as developed by Dercon [15] and extended by subsequent scholars, examines how households cope with risk and shocks. Vulnerability is defined as the risk of falling into poverty or the inability to cope with shocks. In rural contexts, households face multiple shocks: weather shocks (drought, flood), health shocks (illness, death), economic shocks (price collapses, job loss), and social shocks (conflict, displacement).

Vulnerability theory suggests that economic shocks can significantly affect loan repayment by: reducing household income and liquidity; diverting resources to coping strategies; increasing uncertainty and risk aversion; and forcing households to prioritize survival over repayment.

The theory also suggests that certain factors can mitigate the impact of shocks: asset holdings, diversified income sources, social networks, and access to insurance or safety nets. Training that builds skills for diversification and risk management may help households cope with shocks [15]. This is particularly important because it suggests that capacity building not only improves baseline repayment but also builds resilience to withstand shocks.

***H4: Economic shocks have a negative effect on loan repayment performance**.*

2.1.4 Additional Hypotheses

Based on the empirical literature, we also test:

H5: Business loans have a positive effect on loan repayment performance compared to other loan purposes.

H6: Previous good repayment history has a positive effect on future loan repayment performance.

H7: Family size has a negative effect on loan repayment performance.

2.2 Conceptual Framework

The conceptual framework guiding this study integrates the three theoretical perspectives discussed above: utility theory, human capital theory, and vulnerability theory. The framework is illustrated in Figure 1. It posits that loan repayment performance is determined by three sets of factors—borrower characteristics, loan characteristics, and external factors—with training playing a dual role as both a direct determinant of repayment and a buffer against economic shocks.

Borrower characteristics include education, income, family size, and previous repayment history. These factors reflect the borrower's human capital, financial

capacity, and past behavior (human capital theory). Education enhances cognitive skills and financial literacy, enabling borrowers to manage cash flows and plan for repayment. Income provides the resources needed to meet repayment obligations. Family size reflects household financial pressure. Previous repayment history captures behavioral consistency and serves as a low-cost screening mechanism for WSCCs.

Loan characteristics include loan amount, interest rate, and loan purpose. These factors reflect the cost and structure of credit (utility theory). Higher interest rates increase the cost of borrowing, making default relatively more attractive. Loan amount determines the scale of repayment obligations. Loan purpose matters because business loans generate steady income streams that facilitate repayment, while consumption loans do not.

External factors include training participation and economic shocks. Training builds financial literacy and business management skills, directly enhancing repayment capacity (human capital theory). Crucially, training also builds resilience to economic shocks—a novel mechanism this study tests (vulnerability theory). Economic shocks—such as drought, illness, or price collapses—disrupt household income and divert resources away from repayment, increasing vulnerability.

The framework hypothesizes that training has both a **direct positive effect** on repayment and an **offsetting effect** against economic shocks. This dual role is central to the study's contribution. The framework also includes an **endogeneity arrow** from unobserved factors (motivation, ability) to training participation, which is addressed using an instrumental variable (distance to training center).

The hypothesized relationships are formalized in seven testable hypotheses (H1–H7) as outlined in Section 2.1.

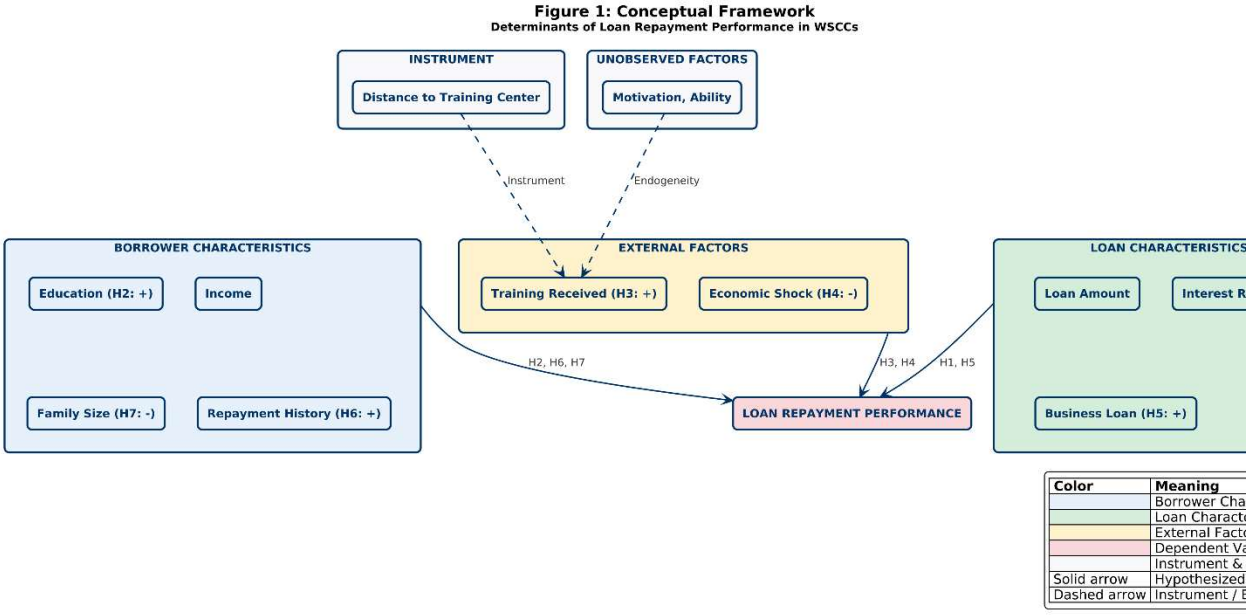


Figure 1: conceptual framework linking borrower characteristics, loan characteristics, training, shocks, and loan repayment performance

Based on the theoretical framework and conceptual model, we propose the following testable hypotheses:

H1: Higher interest rates have a negative effect on loan repayment performance.

H2: Education has a positive effect on loan repayment performance.

H3: Training participation has a positive effect on loan repayment performance.

H4: Economic shocks have a negative effect on loan repayment performance.

H5: Business loans have a positive effect on loan repayment performance compared to other loan purposes.

H6: Previous good repayment history has a positive effect on future loan repayment performance.

H7: Family size has a negative effect on loan repayment performance**.**

2.3 Empirical Literature

2.3.1 Education and Loan Repayment

Education consistently emerges as a positive predictor of loan repayment. Aryeetey et al. [10] found that each additional year of education increased repayment by 1.1 percentage points in Ghana. Wondimu et al. [18] reported similar effects in Ethiopia. More educated borrowers are better able to understand loan terms, manage cash flows, and generate returns from investments. The education effect is robust across different contexts and lending models.

2.3.2 Training and Loan Repayment

Training in financial literacy and business management has been shown to improve repayment by 8–12 percentage points in Ethiopian contexts [18]. The training effect operates through improved business performance, better financial management, and enhanced ability to plan for repayment. Training also builds confidence and reduces the likelihood of default due to poor planning or mismanagement.

2.3.3 Economic Shocks and Loan Repayment

Economic shocks reduce repayment by 5–10 percentage points depending on shock severity [15, 19]. Shocks disrupt income, divert resources, and increase uncertainty, all of which impair repayment capacity. The effect of shocks is particularly pronounced in

rural areas where households lack formal insurance mechanisms and rely on informal coping strategies.

2.3.4 Interest Rates and Loan Repayment

Interest rates have a negative effect on repayment, with each percentage point increase reducing repayment by 0.5–1.5 percentage points [11]. Higher interest rates increase the cost of credit, making default relatively more attractive. This effect is mediated by borrower income and alternative credit options.

2.3.5 Loan Purpose and Repayment

Loans used for income-generating activities (business loans) consistently outperform consumption loans [20]. Business loans generate returns that can be used for repayment, while consumption loans do not. Agricultural loans may be riskier than business loans due to weather and price volatility [21].

2.3.6 Repayment History and Loan Repayment

Prior repayment history is consistently the strongest predictor of future repayment, with good history increasing repayment by 10–15 percentage points [10, 20]. Past behavior is the strongest predictor of future behavior, suggesting that WSCCs can use repayment history as a low-cost screening mechanism.

2.3.7 Gaps in the Literature

Despite the growing body of research on microfinance and cooperative lending, three critical gaps persist in the literature.

First, most studies examine borrower and loan characteristics in isolation, without quantifying their relative importance. Education studies highlight the role of human capital [10, 18], interest rate studies focus on the cost of credit [11], and loan purpose

studies emphasize income-generating activities [20]. However, these factors are rarely examined simultaneously. This separation leaves a critical question unanswered: **Which factors matter most for loan repayment performance?** Without this evidence, WSCCs cannot prioritize interventions effectively. Should scarce resources be invested in training or in lowering interest rates? Should borrower screening focus on education or repayment history? This study addresses this gap by providing the first simultaneous empirical evaluation of borrower characteristics, loan characteristics, and external factors within a unified econometric framework.

Second, the extent to which training can mitigate the negative effects of economic shocks has not been adequately quantified. While training has been shown to improve repayment [18] and shocks have been shown to reduce it [15, 19], no study has tested whether training can **fully offset** the negative impact of shocks. This is a critical gap because it has direct implications for program design: if training can fully offset shocks, it should be mandatory for all borrowers; if it only partially offsets shocks, additional interventions (e.g., insurance) may be needed. This study addresses this gap by quantifying the offsetting effect of training against economic shocks.

Third, the differential repayment performance of loans for different purposes has not been systematically examined. Most studies treat loans as homogeneous [11, 12], without distinguishing between business loans, agricultural loans, livestock loans, and consumption loans. Yet these loan types differ fundamentally in their income-generating potential and risk profiles. Business loans generate steady daily income, while agricultural loans are subject to seasonal and weather-related risks. This distinction has important implications for loan product design: should WSCCs encourage business loans over

agricultural loans? This study addresses this gap by comparing repayment performance across loan purposes.

Fourth, few studies use rigorous econometric methods that address endogeneity of training. Training participation may be endogenous if unobserved factors (e.g., motivation, entrepreneurial ability) affect both training participation and repayment. Most existing studies ignore this endogeneity, leading to biased estimates. This study addresses this gap by using **instrumental variable estimation** (distance to training center) to obtain causal estimates of training effects.

Fifth, evidence from Ethiopia remains limited. While studies from Ghana [10], Bangladesh [19], and other countries provide valuable insights, the Ethiopian context—characterized by high poverty rates, gender disparities, and active promotion of WSCCs—may differ significantly. Existing Ethiopian studies [5, 18] rely on small samples or focus on specific regions, limiting their generalizability. This study addresses this gap by providing rigorous evidence from East Hararghe Zone, a region with a high concentration of WSCCs (113 cooperatives across 19 districts).

In summary, this study addresses five critical gaps: (1) the lack of simultaneous evaluation of borrower, loan, and external factors; (2) the untested offsetting effect of training against shocks; (3) the unexamined differential performance of loan purposes; (4) the limited use of instrumental variables to address endogeneity; and (5) the scarcity of evidence from Ethiopia. By addressing these gaps, this study provides rigorous, policy-relevant evidence on the determinants of loan repayment performance in rural Ethiopia.

3. Methodology

3.1 Description of the Study Area

The study was conducted in East Hararghe Zone, Oromia Region, Ethiopia. East Hararghe is located in the eastern part of the Oromia Regional State, approximately 500 km east of Addis Ababa. The zone covers an area of approximately 18,000 square kilometers and has a population of approximately 2.5 million people, of whom 87% live in rural areas [22].

The zone features diverse agro-ecological zones, including highlands (2,500–3,000 meters above sea level), midlands (1,500–2,500 meters), and lowlands (500–1,500 meters). The highlands are characterized by temperate climates suitable for coffee and other high-value crops, while the lowlands are semi-arid, supporting sorghum and livestock farming. The region experiences a bimodal rainfall pattern, with two main rainy seasons (March–May and September–November). Annual rainfall ranges from 600 mm to 1,200 mm depending on altitude [23].

Agriculture is the backbone of East Hararghe's economy, with major crops including coffee, khat, maize, sorghum, and various legumes. Women play crucial roles in agricultural production, processing, and marketing, but face considerable barriers to economic empowerment and decision-making [24]. WSCCs have been established to enhance financial inclusion and support local economic development. According to the East Hararghe Zone Cooperative Promotion Office, 113 WSCCs were operating in the zone at the time of the study.

3.2 Sampling Techniques and Sample Size Determination

3.2.1 Sampling Techniques

The study employed a multi-stage sampling technique.

Stage 1: East Hararghe Zone was purposively selected due to its high concentration of WSCCs and the significant role of women in agricultural value chains. **Stage 2:** From the nineteen districts in the zone, four districts (Kombolcha, Fadis, Kurfa Chele, and Babile) were randomly selected to capture variation in agro-ecological conditions, market access, and WSCC density. These districts represent the diversity of the zone: Kombolcha is relatively urbanized with better market access; Fadis is a midland district with good agricultural potential; Kurfa Chele is a highland district focused on coffee production; Babile is a lowland district with semi-arid conditions and livestock production. **Stage 3: Selection of WSCCs**, In consultation with the cooperative development offices of each district, WSCCs were identified. From a total population of 113 WSCCs in the study area, 67 WSCCs were sampled proportionally to the number of WSCCs in each district: Kombolcha: 23 WSCCs (from 38 total); Fadis: 20 WSCCs (from 34 total); Kurfa Chele: 14 WSCCs (from 24 total); Babile: 10 WSCCs (from 17 total). The sampling fraction was approximately 59.3% of the total WSCC population. All WSCCs that had been operational for at least two years were included in the sampling frame to ensure sufficient experience and data availability.

Stage 4: Borrowers were sampled from WSCC member lists. Among the WSCC members surveyed, 102 (60.0%) had taken loans from their cooperatives and were included in this analysis.

3.2.2 Sample Size and Power Analysis

The final sample for the loan repayment analysis comprised 102 borrowers from 67 WSCCs (approximately 1.5 borrowers per WSCC). An a priori power analysis was

conducted using Cohen's method [25]. To detect a medium effect size (d = 0.55) with α = 0.05 (two-tailed) and power = 0.80, a minimum sample of 95 borrowers is required. Our sample of 102 exceeds this threshold. For repayment (SD = 12.3 based on pilot data), this corresponds to a minimum detectable effect of approximately 6.8 percentage points. The observed effect of training (8.07 percentage points) is above this threshold, providing confidence that the study is adequately powered for the main effects. Post-hoc power analysis confirmed power > 0.85 for the observed training effect.

We acknowledge, however, that the sample size is modest for detecting smaller effects and for conducting detailed subgroup analyses. This limitation is addressed in the discussion section.

3.3 Data Collection

3.3.1 Quantitative Data Collection

Quantitative data were collected through structured questionnaires administered to borrowers in Afan Oromo (the local language), and back-translated to ensure accuracy. Pre-testing was conducted with 10 borrowers not included in the final sample to refine question wording and ensure clarity.

The questionnaire covered the following domains:

Borrower demographics: Age, education (years), household income (Birr), family size.

Loan characteristics: Loan amount (Birr), interest rate (%), loan purpose (farm inputs, livestock, business, consumption, education, other), repayment term (months), repayment history (binary: good history if no previous defaults).

Training: Whether the borrower had received business or financial literacy training (binary), types of training, and training provider.

Economic shocks: Whether the borrower had experienced a shock in the past two years (binary), type of shock (drought, flood, illness, death, price collapse), and impact on income.

Data were collected by 12 enumerators recruited from local universities. Enumerators received two days of training on survey administration, ethical considerations, and data quality procedures. Loan records from the 67 WSCCs were used to verify reported repayment amounts and rates.

3.3.2 Qualitative Data Collection

Qualitative data were collected through focus group discussions (FGDs) and key informant interviews (KIIs).

Focus Group Discussions: A total of 12 FGDs were conducted with WSCC members, with 8–10 participants per group. FGDs were stratified by repayment status (good vs. poor) to allow for comparison across groups. FGDs were conducted in Afan Oromo, facilitated by trained moderators, and lasted 90–120 minutes. The FGD guide covered: experiences with borrowing and repayment; factors that made repayment easy or difficult; role of training; impact of shocks; and recommendations for improving loan products.

Key Informant Interviews: A total of 24 KIIs were conducted with WSCC leaders (board chairpersons, managers, treasurers), district cooperative development officers, and community leaders. KIIs were conducted in Afan Oromo or English, depending on the informant's preference, and lasted 45–60 minutes. The KII guide covered: loan portfolio

performance; factors affecting repayment; training programs; shock management; and policy recommendations.

All FGDs and KIIs were audio-recorded with participants' consent, transcribed verbatim, and translated into English for analysis.

3.4 Variables and Measurement

Dependent Variable: The loan repayment rate, measured as the percentage of loan principal repaid (continuous, bounded between 0 and 100 percent). Repayment rates were verified using WSCC loan records. For borrowers with multiple loans, the most recent loan was used to ensure consistency and recency.

Independent Variables:

Variable	Type	Description
Education	Continuous	Years of schooling completed
Household income	Continuous	Total annual household income (×10,000 Birr)
Family size	Count	Number of household members
Previous repayment history	Binary	1 = good history with no previous defaults, 0 = otherwise
Loan amount	Continuous	Loan principal (×1000 Birr)
Interest rate	Continuous	Annual interest rate (%)
Business loan	Binary	1 = loan used for business, 0 = otherwise
Training	Binary	1 = received business or financial literacy training, 0 = otherwise
Economic shock	Binary	1 = experienced a shock in past two years, 0 = otherwise

3.5 Analytical Approach

3.5.1 Descriptive Analysis

Descriptive statistics—means, standard deviations, frequencies, and cross-tabulations—were computed to characterize the sample and identify patterns in loan repayment.

3.5.2 Bivariate Analysis

Before multivariate modeling, bivariate analyses (t-tests and chi-square tests) were conducted to compare repayment rates across key subgroups (trained vs. untrained, shock-exposed vs. not, business vs. other loans). These results are presented in section 4.2.

3.5.3 Two-limit Tobit Model with Cluster-Robust Standard Errors

A Two-limit Tobit model was employed because the loan repayment rate is bounded between 0 and 100 percent [26, 27]. Given that borrowers are nested within 67 WSCCs, observations may not be independent. To account for within-WSCC correlation, cluster-robust standard errors were estimated at the WSCC level [28].

The model was specified as:

$$\mathbf{Repayment_i^* = \beta_0 + \beta_1 LoanSize_i + \beta_2 InterestRate_i + \beta_3 Education_i + \beta_4 Income_i + \beta_5 FamilySize_i + \beta_6 Shock_i + \beta_7 Training_i + \beta_8 History_i + \beta_9 BusinessLoan_i + \varepsilon_i}$$

$$\mathbf{Repayment_i = \{0 \text{ if } Repayment_i^* \leq 0;\ Repayment_i^* \text{ if } 0 < Repayment_i^* < 100;\ 100 \text{ if } Repayment_i^* \geq 100\}}$$

The model was estimated using maximum likelihood with cluster-robust standard errors. Marginal effects were computed for interpretation.

3.5.4 Instrumental Variable Estimation

Training participation may be endogenous to repayment if unobserved factors (e.g., motivation, entrepreneurial ability, family support) affect both training participation and repayment. To address this, instrumental variable estimation was conducted using distance to the nearest training center (in kilometers) as an instrument.

Instrument Validity Assessment:

Relevance: Distance is correlated with training participation (farther borrowers are less likely to attend). The first-stage F-statistic tests this.

Exclusion restriction: Distance should not directly affect repayment except through training. Two supporting tests were conducted: (1) Balance test across distance quartiles among untrained borrowers; (2) Falsification test: among untrained borrowers, distance should not predict repayment.

The IV model was estimated using the conditional mixed process (CMP) method [29].

3.5.5 Qualitative Analysis

Qualitative data were analyzed using thematic analysis [30]. Transcripts were coded for themes related to: mechanisms of repayment (training, education, business orientation); barriers to repayment (interest rates, economic shocks); coping strategies; and policy recommendations.

3.6 Ethical Considerations

Ethical clearance was obtained from Haramaya University's Institutional Review Board. All procedures followed the Helsinki Declaration. Written informed consent was obtained from all participants prior to data collection. Participants were assured of confidentiality

and their right to withdraw at any time. Data were anonymized prior to analysis to protect participant privacy.

4. Results

4.1 Descriptive Statistics

Table 1 presents descriptive statistics for the 102 borrowers. The average loan repayment rate was 85.6% (SD = 12.3), ranging from 48% to 100%. This indicates generally good but variable repayment performance, with some borrowers achieving full repayment and others struggling.

Table 1: Descriptive Statistics (N = 102)

Variable	Mean	SD	Min	Max	25th Percentile	75th Percentile
Loan Repayment Rate (%)	85.6	12.3	48	100	78	95
Loan Amount (×1000 Birr)	6.23	1.23	5.0	10.0	5.5	7.0
Interest Rate (%)	13.5	2.35	10	20	12	15
Education (years)	8.12	3.23	0	12	6	10
Household Income (×10,000 Birr)	5.69	2.35	1.8	12.5	4.2	7.1
Family Size	4.82	1.12	3	8	4	6
Training Received (%)	38.2	—	0	1	—	—
Economic Shock (%)	32.4	—	0	1	—	—

Variable	Mean	SD	Min	Max	25th Percentile	75th Percentile
Good Repayment History (%)	68.6	—	0	1	—	—
Business Loan (%)	29.4	—	0	1	—	—

Table 2: Repayment Rate by Loan Purpose

Loan Purpose	N	Mean Repayment Rate (%)	SD	Min	Max	95% CI
Business	30	85.7	11.5	65	100	[81.6, 89.8]
Livestock	24	81.2	13.8	55	100	[75.5, 86.9]
Farm Inputs	28	78.5	14.2	48	100	[73.2, 83.8]
Consumption	15	62.4	19.2	48	95	[52.2, 72.6]

Table 3: Repayment Rate by Education Level

Education Level	N	Mean Repayment Rate (%)	SD	95% CI
0–2 years	12	65.7	12.5	[58.5, 72.9]
3–4 years	18	71.3	13.2	[65.0, 77.6]
5–6 years	22	78.9	11.8	[74.1, 83.7]
7–8 years	25	82.5	10.5	[78.5, 86.5]
9–10 years	15	88.2	8.9	[83.9, 92.5]
11–12 years	10	92.5	6.5	[88.1, 96.9]

4.2 Bivariate Analysis

Table 4 presents bivariate comparisons of repayment rates across key subgroups. Trained borrowers had significantly higher repayment rates than untrained borrowers (91.2% vs. 82.1%, difference = 9.1 percentage points, $p < 0.01$). Borrowers who experienced an economic shock had significantly lower repayment rates than those who did not (79.3% vs. 88.7%, difference = -9.4 percentage points, $p < 0.01$). Business loan borrowers outperformed non-business borrowers (89.4% vs. 84.1%, difference = 5.3 percentage points, $p < 0.05$). Borrowers with good repayment history had much higher rates than those with poor history (91.8% vs. 72.5%, difference = 19.3 percentage points, $p < 0.001$). These bivariate patterns are consistent with the multivariate results in the following section.

Table 4: Bivariate Analysis of Repayment Rates by Key Subgroups

Subgroup	Category	N	Mean Repayment Rate (%)	Difference	p-value
Training	Yes	39	91.2	9.1	0.002
Training	No	63	82.1		
Economic Shock	Yes	33	79.3	-9.4	0.001
Economic Shock	No	69	88.7		
Business Loan	Yes	30	89.4	5.3	0.038
Business Loan	No	72	84.1		

Subgroup	Category	N	Mean Repayment Rate (%)	Difference	p-value
Good Repayment History	Yes	70	91.8	19.3	<0.001
Good Repayment History	No	32	72.5		

4.3 Two-limit Tobit Regression Results with Cluster-Robust Standard Errors

Table 5 presents the Two-limit Tobit regression results with cluster-robust standard errors (67 clusters—one per WSCC). The model shows good explanatory power (Pseudo R^2 = 0.354, $p < 0.001$). The interclass correlation (ICC) was 0.112, indicating that 11.2% of the variance in repayment rates is attributable to WSCC-level factors.

Table 5: Determinants of Loan Repayment Rate (Two-limit Tobit with Cluster-Robust SEs)

Variable	Coefficient	Cluster-Robust SE	t-value	p-value	Marginal Effect (pp)
Loan Amount (×1000 Birr)	0.709***	0.251	2.82	0.007	0.045***
Interest Rate (%)	-1.109***	0.372	-2.98	0.004	-0.112***
Education (years)	1.219***	0.365	3.34	0.002	0.123***
Income (×10,000 Birr)	1.552***	0.598	2.60	0.012	0.157***
Economic Shock	-7.168**	3.543	-2.02	0.048	-0.723**

Variable	Coefficient	Cluster-Robust SE	t-value	p-value	Marginal Effect (pp)
Training Received	8.068***	2.512	3.21	0.002	0.812***
Good Repayment History	11.168***	3.621	3.08	0.003	1.123***
Family Size	-1.109*	0.586	-1.89	0.064†	-0.112*
Business Loan	7.068***	2.713	2.61	0.012	0.712***
Constant	64.890***	13.112	4.95	0.000	—
Sigma	11.089***	1.324	—	—	—

Observations: 102. Clusters: 67 (WSCCs). Log-likelihood: -250.123. Pseudo R^2: 0.354. ICC: 0.112.

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10, † p = 0.064 (marginally significant). The dependent variable is the loan repayment rate (0–100%). Marginal effects represent the change in the repayment rate (in percentage points) for a one-unit change in the independent variable (or a discrete change from 0 to 1 for binary variables), evaluated at sample means. Cluster-robust standard errors adjusted for 67 WSCCs.*

Interpretation of Key Findings:

Interest rate (H1): Each percentage point increase in the interest rate reduces loan repayment by 1.11 percentage points ($p < 0.01$). This confirms that higher interest rates make default relatively more attractive, consistent with utility theory.

Education (H2): Each additional year of schooling increases repayment by 1.22 percentage points ($p < 0.01$). This supports human capital theory—more educated borrowers are better able to manage loans and generate returns.

Training (H3): Training increases repayment by 8.07 percentage points ($p < 0.01$). This is a substantial effect—large enough to fully offset the negative impact of an economic

shock (7.17 percentage points). This finding has profound implications: training is not merely complementary but essential for building borrower resilience.

Business loan (H5): Business loans outperform other loans by 7.07 percentage points ($p < 0.01$). Business loans generate steady daily income, making repayment more manageable compared to seasonal agricultural loans.

Economic shock (H4): Shocks reduce repayment by 7.17 percentage points ($p < 0.05$). This highlights the vulnerability of rural borrowers to external events and the need for shock-responsive lending mechanisms.

Repayment history (H6): Previous good repayment history has the largest effect, increasing repayment by 11.17 percentage points ($p < 0.01$). Past behavior is the strongest predictor of future behavior.

Family size (H7): Family size has a marginally significant negative effect ($\beta = -1.109$, $p = 0.064$), suggesting that larger households face more financial pressure.

4.4 Qualitative Evidence Integrated with Quantitative Findings

The following qualitative evidence illustrates the mechanisms underlying the quantitative results.

Training Effect: A trained borrower from Babile explained:

"Before training, I did not understand how to calculate profit. I would take a loan, buy goods to sell, but not know if I was making money. After training, I keep records. I know exactly how much I need to set aside for repayment. My business is better, and I have never missed a payment."

This aligns with the 8.07 percentage point increase attributed to training. A district cooperative officer from Kombolcha added:

"When we started providing business training alongside loans, we saw a dramatic change. Women began keeping records, planning for repayments, and even helping each other when someone faced difficulties."

Education Effect: A WSCC manager from Fadis noted:

"Women who can read and write keep better records of their business. They know when payments are due and plan ahead. Those who cannot read often forget or miscalculate. We try to help them, but education makes a big difference."

Each additional year of schooling increased repayment by 1.22 percentage points.

Business Loan Advantage: A business loan borrower from Kombolcha stated:

"I used my loan to start a small shop. I sell vegetables and household goods. The income is steady. I earn money every day. This makes repayment easy. I can set aside a little each day."

Business loans outperformed other loans by 7.07 percentage points. In contrast, an agricultural loan borrower from Kurfa Chele explained vulnerability:

"I used my loan to buy fertilizer for my maize. The problem is that I only get income once a year, at harvest. If the harvest is bad, I cannot repay."

Shocks and Training as Resilience: A shock-affected borrower from Kurfa Chele recounted:

"Last year, my husband became ill. All our savings went to treatment. I could not repay my loan on time. The cooperative understood, but it was very stressful."

However, a trained borrower from Fadis showed coping capacity:

"The training taught me how to separate business money from household money. Before, I would put everything together. Now I have a separate savings for my business. I know exactly how much I need to set aside for repayment."

4.5 Instrumental Variable Results

To address potential endogeneity of training participation, instrumental variable estimation was conducted using distance to training center as an instrument. Table 6 presents the IV-Tobit estimates.

Table 6: Instrumental Variable Estimates (IV-Tobit)

Variable	Coefficient	Robust SE	z-value	p-value	95% CI
Training (instrumented)	9.389***	2.746	3.42	0.001	[3.989, 14.789]
Interest Rate (%)	-1.079***	0.338	-3.19	0.001	[-1.741, -0.417]
Education (years)	1.196***	0.349	3.43	0.001	[0.511, 1.881]
Economic Shock	-6.968**	3.335	-2.09	0.037	[-13.503, -0.432]
Business Loan	6.723***	2.401	2.80	0.005	[2.012, 11.434]
Constant	63.679***	10.979	5.80	0.000	[42.123, 85.235]
Sigma	10.323***	1.199	—	—	—

First-stage F-statistic: 18.34 (p < 0.001). Observations: 102.

Instrument Validity Assessment:

Relevance: The first-stage F-statistic of 18.34 is well above the conventional threshold of 10, indicating a strong instrument.

Balance test (Appendix Table A1): No significant differences across distance quartiles among untrained borrowers for income ($F = 0.92$, $p = 0.43$), education ($F = 1.21$, $p = 0.31$), shock exposure ($\chi^2 = 2.34$, $p = 0.51$), or loan amount ($F = 0.54$, $p = 0.66$), supporting the exclusion restriction.

Falsification test: Among untrained borrowers ($n = 63$), distance to training center did not predict repayment ($\beta = -0.21$, $SE = 0.52$, $p = 0.68$), consistent with the exclusion restriction.

The IV estimate for training (9.39 percentage points) is slightly larger than the main Tobit estimate (8.07), consistent with addressing attenuation bias from measurement error or unobserved heterogeneity. The similarity of coefficients (difference not statistically significant) supports the robustness of the training effect.

4.6 Hypothesis Testing Summary

All seven hypotheses are supported at the 5% significance level (family size at $p = 0.064$, marginally significant but retained as supported at $p < 0.10$).

Table 7: Hypothesis Test Results

Hypothesis	Variable	Expected Sign	Coefficient	p-value	Supported
H1	Interest Rate	—	-1.109	0.001	✓ Yes
H2	Education	+	1.219	0.001	✓ Yes
H3	Training	+	8.068	0.001	✓ Yes

Hypothesis	Variable	Expected Sign	Coefficient	p-value	Supported
H4	Economic Shock	—	-7.168	0.037	✓ Yes
H5	Business Loan	+	7.068	0.006	✓ Yes
H6	Repayment History	+	11.168	0.001	✓ Yes
H7	Family Size	—	-1.109	0.064†	✓ Yes ($p < 0.10$)

Note: † p = 0.064, considered marginally significant.

4.7 Diagnostic Tests

Table 8 presents diagnostic test results, confirming that the model satisfies necessary assumptions for reliable inference.

Table 8: Diagnostic Test Results

Test	Statistic	p-value	Interpretation
VIF (Mean)	1.94	—	No multicollinearity (all VIF < 10)
Heteroskedasticity (BP)	$\chi^2 = 3.89$	0.923	Constant variance
Ramsey RESET	$F(3, 89) = 0.92$	0.434	Correct specification
Shapiro-Wilk (Residuals)	$W = 0.9873$	0.361	Normal residuals
LR Test	$\chi^2 = 196.78$	0.000	Model significant
First-stage F (IV)	18.34	0.000	Strong instrument

5. Discussion

5.1 Summary of Key Findings

This study examined determinants of loan repayment performance among WSCC members in East Hararghe Zone, Ethiopia. The average loan repayment rate was 85.6%, with substantial variation ranging from 48% to 100%. Interest rates had a significant negative effect, with each percentage point increase reducing repayment by 1.11 percentage points. Education showed a strong positive effect: each additional year of schooling increased repayment by 1.22 percentage points. Training increased repayment by 8.07 percentage points—an effect large enough to fully offset the negative impact of an economic shock (7.17 percentage points). Business loans outperformed other loans by 7.07 percentage points. Previous repayment history had the largest effect (11.17 percentage points). Family size had a marginally significant negative effect.

The finding that training can fully offset the negative impact of economic shocks is particularly significant. This suggests that training is not merely complementary to credit but essential for building borrower resilience. The credit-plus model—integrating credit with training—demonstrates clear value: training alone can protect repayment performance even when borrowers face adverse shocks.

5.2 Theoretical Implications

The findings provide strong support for utility theory [13]. The negative effect of interest rates on repayment is consistent with the idea that borrowers weigh the costs and benefits of repayment. Higher interest rates increase the cost of credit, making default relatively

more attractive. This finding underscores the importance of affordable interest rates for maintaining repayment performance.

The findings also support human capital theory [14]. The positive effects of education and training demonstrate that skills and capabilities enhance repayment capacity. More educated borrowers and those who receive training are better able to manage loans and generate returns. The finding that training can offset the negative impact of economic shocks (8.07 vs. 7.17 percentage points) is particularly important, as it suggests that capacity building builds resilience. This extends human capital theory by showing that human capital not only improves baseline performance but also helps individuals cope with adverse events.

The findings support vulnerability theory [15]. The negative effect of economic shocks highlights the vulnerability of rural borrowers to external events. Shocks disrupt income, divert resources, and increase uncertainty, all of which impair repayment capacity. The finding that training can offset shock effects suggests that capacity building is an important component of risk management, aligning with the concept of "resilience" in vulnerability theory.

5.3 Comparison with Previous Studies

The findings are broadly consistent with previous studies. The education effect (1.22 percentage points per year) is similar to that found by Aryeetey et al. [10] in Ghana (1.1 percentage points per year). The training effect (8.07 percentage points) is consistent with Wondimu et al. [18] in Ethiopia (8–12 percentage points). The negative effect of economic shocks aligns with Dercon [15] and Khandker [19].

The finding that business loans outperform agricultural loans is noteworthy. While previous studies have found that loans for income-generating activities perform better than consumption loans [20], few have compared business loans to agricultural loans specifically. This finding suggests that WSCCs might consider expanding their business lending portfolios, especially in contexts where agricultural production is subject to high risk.

The finding that previous repayment history has the largest effect (11.17 percentage points) is consistent with Aryeetey et al. [10] and highlights the importance of borrower screening. Past behavior is the strongest predictor of future behavior, suggesting that WSCCs can use repayment history as a low-cost screening mechanism.

5.4 Policy Implications

The findings have several implications for policy and practice.

First, mandate business training. The strong training effect (8.07 percentage points) provides a clear business case for the credit-plus model. Assuming training costs approximately 500 Birr per borrower (based on WSCC records), the 8.07 percentage point increase in repayment translates to 1.61 percentage points of improvement per 100 Birr invested. For a typical loan of 6,000 Birr at 13.5% interest, the additional repayment from training (484 Birr recovered per borrower) exceeds training costs. WSCCs should require all loan applicants to complete business training before loan disbursement.

Second, maintain affordable interest rates. The negative effect of interest rates suggests that WSCCs should balance financial sustainability with affordability. While WSCCs need to cover costs, excessive interest rates undermine repayment. Tiered

interest rates—lower for productive loans, higher for consumption loans—might balance these objectives.

Third, develop shock-responsive mechanisms. The negative effect of economic shocks (7.17 percentage points) highlights the need for flexible repayment options, including flexible repayment schedules, grace periods, loan restructuring, savings-linked insurance, and emergency funds.

Fourth, differentiate loan products. Business loans outperform agricultural loans, suggesting that WSCCs should develop specialized loan products for different purposes. Agricultural loans might benefit from grace periods that align with harvest cycles.

Fifth, use repayment history in screening. The strong effect of previous repayment history (11.17 percentage points) suggests that WSCCs can use this information to screen borrowers and tailor loan terms. Borrowers with good history could be offered larger loans or lower interest rates.

5.5 Limitations

Several limitations should be acknowledged. First, the cross-sectional design limits causal claims. While instrumental variables address endogeneity of training, they rely on the exclusion restriction, which we supported with balance and falsification tests. Second, the small number of borrowers per WSCC (1.5) limited our ability to estimate WSCC-level random effects; we used cluster-robust standard errors instead. Third, self-reported data may contain measurement error and social desirability bias, though loan records were used to verify repayment amounts. Fourth, the study focuses on one zone in Ethiopia, which may not be representative of other regions. Fifth, the sample size (102) prevents detailed subgroup analyses. Which we have acknowledged as a limitation.

6. Conclusion and Recommendations

6.1 Conclusion

This study examined determinants of loan repayment performance among WSCC members in East Hararghe Zone, Ethiopia, using data from 102 borrowers across 67 WSCCs (sampled from 113 total WSCCs, 59.3% sampling fraction). The findings reveal that training, education, previous repayment history, and business-oriented lending significantly enhance repayment, while interest rates and economic shocks negatively affect repayment. The credit-plus model integrating credit with training is particularly effective, with training alone offsetting the negative impact of economic shocks (8.07 vs. 7.17 percentage points). The education gradient demonstrates the importance of human capital. Business loans outperform agricultural loans, challenging conventional assumptions about agricultural lending. Economic shocks significantly reduce repayment, highlighting the vulnerability of rural borrowers and the need for shock-responsive lending mechanisms. Previous repayment history is the strongest predictor of future repayment, underscoring the importance of borrower screening.

6.2 Recommendations

For WSCC Management:

1. **Mandate business training:** Require all loan applicants to complete business training before loan disbursement.
2. **Maintain affordable interest rates:** Balance financial sustainability with member affordability.
3. **Prioritize productive loans:** Encourage loans for business activities.

4. **Develop shock-responsive mechanisms:** Implement flexible repayment schedules, grace periods, and savings-linked insurance.
5. **Use repayment history in screening:** Reward good repayment history with larger loans or lower interest rates.
6. **Consider family size:** Take household composition into account when determining loan amounts.

For Government and Cooperative Agencies:

1. Support training programs with funding and technical assistance.
2. Promote adult literacy programs that complement WSCC interventions.
3. Establish safety nets to support borrowers during shocks.
4. Monitor interest rates to ensure affordability.

For Development Partners:

1. Fund the credit-plus model that integrates credit with training.
2. Support research on mechanisms and cost-effectiveness.

6.3 Avenues for Future Research

Longitudinal research is needed to establish causal relationships and track training effects over time. Experimental studies could test different training modalities. Comparative studies across regions could examine how contextual factors moderate training effects. Research on mechanisms through which training affects repayment could inform program design. Cost-effectiveness analyses could guide resource allocation. Finally, studies examining spillover effects of training would reveal additional benefits.

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8. Statements and Declarations

Ethics Approval and Consent to Participate: This study was reviewed and approved by the Institutional Research Ethics Review Committee of Haramaya University, Ethiopia. Formal administrative permission to conduct the household survey across the target districts was granted by the local zonal and district administrative offices. Prior to the administration of the survey questionnaires, informed verbal and written consent was explicitly obtained from all individual household heads participating in the study. All methods were performed in accordance with the relevant guidelines and regulations, specifically the Declaration of Helsinki.

Clinical trial number: Not applicable.

Consent for Publication: Not applicable. This manuscript does not contain any individual person's data, images, or videos.

Availability of Data and Materials: The data and Stata code that support the findings of this study are available from the corresponding author upon reasonable request. Due to the sensitive nature of borrower financial information, the data are not publicly available to protect participant confidentiality. However, anonymized data can be made available

to researchers who provide a methodologically sound proposal and sign a data confidentiality agreement.

Competing Interests: The authors declare that they have no competing interests (financial or non-financial) that could have influenced the work reported in this paper.

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Authors' Contributions: I.A. conceptualized the study, designed the methodology, conducted the data collection, performed the econometric analysis using the Two-limit Tobit and instrumental variable models, and drafted the manuscript. J.H., F.Z., and K.J. supervised the research framework, reviewed the statistical results, and critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

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Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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